mation as defined by the United States Geological Survey was referred as far back as 1888, as Jurassic formation.

JULES MARCOU.

CAMBRIDGE, MASS., December, 1896.

SOME NEURAL AND DESCRIPTIVE TERMS.

TO THE EDITOR OF SCENCE: In a recent circular asking the opinions of experts as to the prevailing and preferred usage of anatomic and neurologic terms in behalf of the projected Dictionary of Philosophy and Psychology, Dr. C. L. Herrick mentions certain terms and principles which have been either proposed or adopted by me.

But for the request to 'respond as early as possible,' I should suggest that replies be either delayed or regarded as provisional until after the appearance of my paper, 'Neural Terms, International and National,' *Journal of Comparative Neurology*, VI., pp. 216–340, December, 1896), wherein the general subject is discussed at length, and in parallel columns are given the neuronyms adopted by the Anatomische Gesellschaft in 1895 and those now preferred by me. But for the remoteness of Dr. Herrick's present address the following comments would be submitted to him first.

3 (b). For the part now called by the Gesellschaft 'Subtantia perforata lateralis' I formerly proposed *præperforata*, but since 1889 have employed *præcribrum*.

4 (e). *Metencephalon*, as employed in the last three editions of 'Quain' and adopted by me in 1881, designates the last definitive encephalic segment, *i. e.*, between the cerebellar segment (our epencephalon) and the myelon or spinal cord. As given in the circular it has two other usages, viz., either for the cerebellar segment alone (His) or for both regions (some authors). The encephalic segments will form the subject of a paper at the coming meeting of the Association of American Anatomists.

(g). *Metencoele* is doubtless a misprint for *metacoele*. The Latin (international) forms are *metacoelia* and *mesocoelia*; the national English forms *metacele* and *mesocele*.

(j). As to *Neuron* (proposed by me in 1884 as a mononym for *axis cerebro-spinalis*) see 'Reference Handbook, IX., 100, and *Proceedings Assoc. Amer. Anat.*, 1895, 44–45. Indirect endorsement of it is contained in such compounds as *neuromere*, *neurenteric*, etc. It like manner *myelencephalon* (for either the entire cerebrospinal axis or for the last encephalic segment) embodies indirect endorsement of *myelon* for *medulla spinalis*.

As to *cephalic* and *caudal*, *cephalad* and *caudad*, during an experience of sixteen years no actual instance of misapprehension has been observed. But since they evidently are not acceptable to some, might not the increasing employment of *præ* and *post* in composition with the force of adjectives, justify taking these prepositions as the bases of adjectives, viz. *præalis*, *postalis*, England, *præal* and *postal*; adverbs, *præad* and *postad*. As mere vocables the last two are no more objectionable than *quoad*. Classic precedents for the derivation of adjectives from prepositions or adverbs are *contrarius*, *extraneus*, *proprius*, *crastinus*, *pristinus*, *interior*, *supernus*, and *ἀηώτερος*. BURT G. WILDER.

ITHACA, N. Y., December 19, 1896.

SCIENTIFIC LITERATURE.

CARL VOGT.

La Vie d'un Homme, Carl Vogt. Par William Vogt. Avec deux portraits par Otto Vautier. Paris, Libraire C. Reinwald; Stuttgart, E. Nägele. 1896. 4°. Pp. 265.

The life of this well-known naturalist was stormy and eventful, in a degree momentous to science, and also to the political and philosophical history of his time. His son has given us a vivid portrait of an interesting character—a very positive one—who, besides leaving his imprint on the science of his day, was in some respects a many-sided man, not only being an eminent investigator, a teacher, a founder of scientific societies, a popular lecturer, a brilliant caustic writer and controversialist, but also a man of great public spirit, an active republican, almost a revolutionist, protesting and fighting during the middle of this century for right and justice against the ultra-conservative, reactionary forces in State and Church.

Carl Vogt was born in 1817 at Giessen. He was by extraction a Celt, rather than a German, and this may account for his turbulent, combative, revolutionary nature, while his pro-

testing spirit and rebellion against the theological trammels of his time betray an infusion of German blood. His materialism he inherited from his father, and the son never deviated from the anti-theological training received under the paternal roof. His biographer writes from the same ultra-materialistic point of view, one scarcely justified in these days of broader and more liberal thought.

Vogt entered the laboratory of Liebig at Giessen, in what year his biographer does not state. Here he began his life-long friendships with Woehler, Bunsen, Hofmann, Kopp, Keculé and other chemists. His first scientific paper (1837) gave the results of a comparative analysis of the water of the amnion at different periods of fœtal life. His father, disgusted with the narrow governmental restrictions of the Grand Duke of Hesse, moved to Berne. Meanwhile at Geissen Vogt had concealed an insurgent in his room, thus risking the penalty of five years' imprisonment in a fortress. The young medical candidate escaped to Strasburg, where he soon neglected medicine and politics, devoting himself to zoology and paleontology. He then studied physiology with Valentin, and thus took his doctor's degree at the age of 21. In this year (1839) his first zoological paper, on the nervous system of Python, appeared.

Meanwhile Agassiz, already distinguished, went in June, 1838, from Neuchâtel to Berne to confer with Prof. William Vogt, the uncle of Carl, who recommended as his assistants Desor and Vogt. The former was at once invited to Neuchâtel, his comrade Vogt joining him a few months after. At this time, as is well known, Vogt wrote the 'Embryogenie et Anatomie des Salmones,' a masterly work. Here Agassiz, '*le chef inconteste*,' worked, housing, clothing and feeding his suite of proletariat collaborators, in the fashion so well known to all the world.

During this life of plain living and high thinking at Neuchâtel, from 1839 to 1844, Vogt published numerous memoirs. He also formed one of the rare spirits who tabernacled for the four summers of 1839 to 1843 on the glacier of the Aar, in the famous *Hôtel des Neuchâtelois*, 8,000 feet above the level of the sea. Here, as Blanchard wrote:

"*Agassiz ne perd jamais sa bonne humeur. Desor s'abandonne volontiers à la plaisanterie, Carl Vogt, toujours petillant d'esprit et capable de mettre en gaieté une assemblée de Trappistes, ne laisse à personne le droit de s'ennuyer.*"

For his gruff but hearty manner, Vogt received the nickname of 'Mutz,' or the bear of Berne.

In 1841, at the meeting of the German naturalists, Vogt supported, against Van Buch, the new theory of Venetz, Charpentier and Agassiz on the former extension of glaciers, and the next year appeared his *Im Gebirg und auf den Gletschern.*

In 1844 we see Vogt at Paris living in the room on the fourth story once occupied by Von Baer, his fellow lodger being Quetelet. They attended the lectures of Arago, Milne-Edwards, Brongniart and Leverrier, his evenings being passed with his fellow students Doyère, Quatrefages, Charles Martins, Bertrand, Sainte-Claire Deville, Würtz, Dumas, Vulpian, Broca and others destined to become distinguished in science and literature.

The three years spent in Paris were busy, prolific, fecund. His vacations were spent partly at St. Malo, where he worked on the embryology of gastropods; other summers were spent in Brittany, in the Black Forest and in the Vosges, and a winter in Italy; afterwards he worked at Nice, and finally at Villefranche. In 1846 appeared his Lehrbuch der Geologie und Petrefactenkunde, which went through five editions; discarding the theory universally held as to the molten interior of the earth, Vogt boldly claimed that the heat was due to metamorphism.

The Physiologische Briefe (1847), in two volumes, with its audacious views and uncompromising materialism, its caustic irony and thrusts at everything venerated by the clerical circles, made a great stir. It was widely read in the German universities and translated into various languages. It treated, for the first time, of the embryonic development of the human body, showing to the laity that man's development is like that of the brutes. Vogt's famous definition of thought has scarcely yet ceased to be criticised and execrated in some quarters. He wrote: "*Toutes les proprietés que nous desig-*

*nons sous le nom d'activité de l' âme, ne sont que les fonctions de la substance cérébrale, et pour nous exprimer d' une façon plus grossière, la pensée est à peu pres au cerveau ce que la bile est au foie et l' urine au rein. Il est absurde d' admettre une âme indépendante qui se serve du cervelet comme d'un instrument avec lequelle travaillerait comme il lui plait.''** But, through Du Bois-Reymond, many have been led to believe that it has a basis of truth, and now nobody is shocked, it may serve as a working hypothesis for the psychologist. Its lack of reserve on philosophical and theological points, its outspoken denial of the immortality of the soul, and other rude and unnecessary thrusts at what was and is held dear by all Christendom, led to the general condemnation of the book.

As late as 1875 the Bishop of Orleans, criticising the review of the French translation of this book, claimed that the 'honteuses et funestes doctrines' expressed in it afforded a basis for the revival of communism in Paris. Even on May 8, 1895, a French Catholic writer ranked Vogt as a moral monster, even claiming that he was as bad as some of the noted murderers of the age.

He also horrified all Europe in another way. Up to 1848 custom demanded the use of the razor. Vogt was the first man in Germany to wear a beard.

He applied for the professorship of zoology at Giessen, the place of his birth, for which he was warmly recommended by Arago, Agassiz, Liebig and others, and despite the detraction and gossip of his opponents he was elected. He arrived at Giessen in April, 1847. The opening address of the new professor electrified the students, who were struck, as his biographer says, by the elevation of his instruction, the ascendency of his amiable spirit and his simple unpretending manner. He had added the last details to the construction of a laboratory of zoology when rumors of the revolutionary movements of 1848, which shook the continent to its foundations, spread through the country and entered the university town of Giessen. Vogt was a republican, but not of the red shade of the French school. He detested Robespierre and his allies. In later times he showed no sympathy with socialists or anarchists. He simply strove for freedom of thought and for justice to the middle classes, such as is now enjoyed, and opposed the reactionary spirit of the wealthy aristocratic and ultra-clerical circles. He was sent to the Parliament and directed the radical left. His polemical spirit, his incisive, caustic raillery, with his persuasive eloquence, his sincerity of conviction and his civic courage, coupled with his lack of pessimistic spirit, made him conspicuous and obnoxious. He was, in consequence of the rising of the republican element, of which he was a natural leader, unseated from his chair at Giessen, in which he was succeeded by R. Leuckart, the 'Nestor of German zoology,' now the distinguished teacher of so many distinguished zoologists at Leipzig. He fled with other refugees to Switzerland, settling down at Berne, but soon went thence to Nice and resumed his former quiet life as an investigator and writer. In 1851 he translated the 'Vestiges of Creation.' The '*Recherches sur les Siphonophores de la mer de Nice*' appeared in 1852.

This volume with his embryology of the salmon, placed him in the first rank of gifted investigators, such as Huxley, Kölliker, Leuckart, Gegenbaur and Milne-Edwards. His sketches were beautifully drawn, his talent for observation had now greatly developed and matured, and his views were original. Meanwhile, he put out a popular work, characterized as before by a trenchant, iconoclastic, uncompromising hostility to the prevailing philosophy and theology. His *Recherches sur les Colonies Animales*, a philippic bristling with political illusions, was placed on the index by the Prussian government, and a writer of the day, on account of the 'heresies and blasphemies of this frivolous and trivial book,' stigmatised it as 'an eternal stain on the zoological literature of Germany.' One of his most successful and widely read books was his '*Zoologischer Briefe*,' sent to the printer in 1851.

* This expression is substantially in Cabanis, who says: The brain produces 'la sécrétion de la penseé (Rapports du Physique et du Moral de l' Homme, Paris, 1844, p. 138). See Lange, ii., p. 312, foot-note, who adds, the editor, L. Peisse, remarks on it: 'Cette phase est restée célèbre.'

Like his other books the style is clear, forcible, piquant, sometimes highly colored, but solid in its facts.

After his acceptance of the chair of geology and zoology at Geneva, which he was at first unwilling to take, Vogt rendered, besides his academic work, public services to his adopted country, aiding with his geological knowledge in the building of railroads, reporting on the geology of the Credo tunnel. He was a member of the Grand Council of the Canton of Geneva from 1856 to 1862, and at other periods until 1880, and of the National Council from 1878 to 1881, and showed his public spirit in other ways, at times when the calm of public life was not always serene and perfect.

His ability and foresight as a man of affairs of the liberal or even radical school, is shown in his open letter in 1859, when he demanded the freedom of Italy and of Hungary, and the unity of Germany. Again, after the Franco-German War of 1870, he suggested that as a means of lasting peace Alsace be given up to the French, truly a statesman-like proposition.

With Sars, Agassiz and Quatrefages, Vogt was one of the first to study living animals at the seashore in an improvised laboratory; but while at Villefranche, in 1850, working on the Siphonophores, he insisted on the importance of laboratories of marine zoology, and the part they should take in the progress of this science, and brought all the influence he could to bear on the Minister of Public Instruction of Austria, to establish a zoological station on the Adriatic sea, at Misamar. Three years later he labored with the Minister of Public Instruction of France to establish such a station at Nice, and recommended as professors, MM. Lacaze-Duthiers and Blanchard. He exerted all possible pressure, says his biographer, on his influential friends in France, Spain, Austria, Germany and Italy to bring about this end, and, we are told by his biographer, it was at his instance and at his instigation that Dr. Anton Dohrn, then (in 1868) at the Congress of Naturalists at Innsbruck, decided to found, at his own expense, the zoological station of Naples, now so successful and magnificent in all its arrangements. He also rendered disinterested services to Lacaze-Duthiers in establishing the admirable station at Roscoff, where he spent several summers, working up there his *Recherches cotières*, and seconded, according to his means and influence, the station of Marion at Marseilles, of Giard at Wimereux, and of Sabatier at Cette. Of late years and up to the year of his death, Vogt worked with his students at the Russian station at Villefranche.

We now have to consider Vogt as an evolutionist. His antipathy to metaphysics and to the philosophy taught when he was young was pronounced. But from the first he sympathized with evolutionary philosophy, and before the time of Haeckel was the leading propagandist of the theory of descent in Germany, and for his active warfare in this direction has been called the Huxley of Germany and Switzerland. He translated the 'Vestiges of Creation' soon after it appeared. With Claparède and DeCandolle, the Gevenese zoologist at once accepted the principles set forth in Darwin's Origin of Species. Even to Vogt it was a revelation.

As early as 1843, in his Embryologie des Salmones, Vogt wrote: "*Le developpement d'une classe dans l'histoire de la terre offre, à divers égards, la plus grande analogie avec le dévelopment d'un individu aux differentes époques de sa vie. La démonstration de cette vérité est un des plus beaux résultat de la paléontologie moderne.*"

In 1851 in his *Zoologische Briefe* he thus expressed himself: "The species is the reunion of all the individuals which derive their origin from the same parents and which become again by themselves or by their descendants like their first ancestors." In his lectures on man, delivered in 1862, he defined a species as a compound of individuals whose characters show that they are the genuine or possible descendants from a common source. In this work he insisted that man had descended from the apes, though he wrongly maintained that the few cases of microcephalous monsters known are cases of reversion to the ape condition. He now actively spread evolutionary views, and in a letter to Huxley, dated March, 1863, he wrote that the doctrine was making "de grand progrès en Allemagne. Une foule de jeunes savants se présentent," that Virchow (now regarded as

very conservative in his views) added fuel to the flames in an article on heredity 'which is very explicit in this sense.' At the same time the radical uncompromising Vogt, when confronted with what was called Haeckelism, for once, and we believe only once, in his life took a conservative stand. The advanced views of Haeckel, then the 'enfant terrible' of Darwinism, with his genealogic tree of the whole animal kingdom, where the vague hypotheses and assertions of the Schöpfunggeschichte and Anthropogenie were treated as if generally received truths, were too much even for Vogt. His mind, so well trained in ascertaining and observing facts and in drawing safe deductions, though accustomed to give hypotheses due regard, led him to believe also that the building of genealogical trees was too premature in the biological science of that date. Vogt rebelled, and for a while a coolness sprang up between the *demi-dieu d'Jena* and himself. Vogt also apparently for the first time felt the influence of the university spirit, and, unconsciously as regards extreme evolutional views, the hair of this republican and ultra radical in religion actually stood on end, and his bold aggressive spirit became reactionary and cautious. Vogt wrote in 1877, under the title 'Apostel-, Propheten- und Orakelthum in der Wissenschaft,' a sharp criticism of Häckelismus; in a moment of genuine indignation, though with its comical side, pronouncing the views of the Jena professor as *haarstraubend*. The daring opinions of Haeckel at that time not only excited the derision of laymen, but biologists of equal rank with Vogt, among them Semper, were astonished at the lengths to which Haeckel allowed his vivid imagination to carry him, and yet at the present day Haeckel's views are moderate compared with those of some biologists. In fact, biology has shifted its methods, and a shoal of hypotheses, some probable and others incapable of proof, now occupy the field.

It was the extreme views of Haeckel against which Agassiz in the United States fought, and though he was the leader of the anti-evolution forces, he and Vogt stood on common ground, *i. e.*, of well ascertained facts, in opposing what they believed to be unsound scientific methods.

Vogt did not, however, like Fritz Müller, whose 'Für Darwin' is a classical work, make any notable contribution to the evolution theory, though upholding the doctrine of descent in its widest acceptation. He, however, did little to broaden it, nor did he, so far as we know, take up the questions now dividing evolutionists into neo-Lamarckians and neo-Darwinians. The scientific criticism of natural selection, the revival and rehabilitation of Lamarckian views, the rise of Weismannism and the search for the physical base of heredity, are the products of a later generation than that of Vogt.

In the summer of 1861 Vogt went as one of the guests of Dr. Berna to the North Cape and Jan Mayen, visiting on the way the eminent naturalist, Sars, and at Bergen Danielssen and Koren, and by the succeeding year (1862) the facile pen of Vogt had thrown off his *Nord-Fahrt entlang der Norwegischen Küste nach dem Nordkap, den Inseln Jan Mayen und Island.*

In the rise of the young science of anthropology, early in the sixties, due to the discoveries of Schmerling, of Boucher de Perthes, of Christy and Lartet, in France; of Thomsen, Nilsson, Steenstrup, Foschhammer, Gabriel de Mortillet, Capellini and others, with the works of Huxley, of Lyell and Lubbock, and the papers of Ecker, Vogt actively participated, and his lectures on man, which appeared in 1863, was a notable work. Aggressive, polemic, unlike the English and others, instead of confining himself to the subject in hand, going out of his way to attack those who differed from him on theological and philosophic subjects, the work made a great stir, perhaps more than its merits really deserved.

Vogt's opinion that microcephalous idiots are cases of reversion to their ape ancestors fell flat on the scientific ear, and indeed the fact was that Vogt himself never saw more than three perfect examples of undeniable microcephals. But the German public was profoundly moved by the popular lectures which the author of *Microcéphales ou Hommes-singes* delivered from 1867 to 1869, in the larger cities of the German Confederation, in Hamburg, Brussels, Antwerp, as well as Vienna and Buda-Pesth. In the Catholic cities he was almost mobbed; the children in the streets would

run after him crying '*Assen Vogt! Assen Vogt!*' On one occasion, while lecturing in a German city, the fanaticism of the lower classes rose to such a pitch that the windows were smashed in by a volley of stones. Vogt, without losing his presence of mind, went on to show his audience the means taken to close the road to the young science already difficult to tread, when a large pebble fell on his desk; he took it and held it up before the assembly and exclaimed: "*Je vous parlais hier des sauvages ancêtres de l'âge de la pierre; vous vous rendrez facilement compte, en ce moment, que cet âge là n'est par encore tout à fait terminé.*" It is said that Broca labored in vain to persuade him to respect the feelings of the lower orders.

Vogt was prominent in founding the Prehistoric Congress of Anthropology initiated by de Mortillet; read a number of papers before it, presenting at the Bologna meeting his paper, *Anthropophagie et les Sacrifices humains*, which contained some extreme conclusions as to the universality of this custom.

In 1870, during the Franco-Prussian War appeared his '*Lettres politiques*,' claimed by his biographer to be 'a fiery and eloquent protest in the name of right, justice and liberty against brutal conquest and unrighteous war,' which were widely read. He warned the French not to underrate the strength of their enemy, and *apropos* of the seizure, by Germany, of Alsace and Lorraine explained what the result has well shown, that this conquest would for a long time prevent any possible reconciliation between the two nations. He deplored the spirit of militarism, which he believed to be the cause of all the evils afflicting Europe, and longed for the suppression of great standing armies.

After this the busy student returned once more to zoology. He translated Gegenbaur's Anatomy, some of Darwin's works, and in 1875 published an *Atlas der Zoologie*. He even printed a study entitled *Structure microscopique des roches volcaniques*, and on volcanoes, and communicated these and other papers to the first meeting of the French Association for the Advancement of Science, which he was specially invited to attend. In his study of the Berlin Archæopteryx (1879), which he vainly tried to obtain for the Geneva museum, he maintained that it was neither a bird or reptile, but formed 'une type intermediaire des plus caractérisés et confirmes, d'une manière éclatante, les vues de M. Huxley.'

In 1879, when the anti-Semitic persecutions arose in Germany, he was among the first to defend the oppressed and plead for just and fair treatment of the Jews, and in 1893, when the anti-Semitic views penetrated into Switzerland, the last public address of the Geneva professor was read by a Federal Councillor before the National Council at Berne.

A characteristic of Vogt, showing his freedom from petty vanity, was his declination of Austrian, Spanish, Danish or Italian decorations, but he gladly accepted the cross of the Chevalier de la Légion d'honneur, given him by Gambetta, his friend and admirer.

His last work, *Traite d'anatomie comparée pratique*, written with the cooperation of Emile Yung, begun in 1888, was completed but a year (1894) before his death. He seems to have left unfinished an autobiography begun in June, 1894. Vogt died, his intellect unclouded to the last, in his eightieth year, March 5, 1895, after an illness of a few weeks.

Such is the life of this man. A busy and, for a naturalist and student, an eventful one. He was remarkably many-sided in his interests, and ever ready to drop his scalpel and pencil to take his share in public affairs.

It has been said that had Vogt not spread over so much ground and had confined himself to zoology, and to a single phase of that many-sided science, he would have taken a higher rank as a man of science. It may be said that he belonged to a school now passing away. He was the product of a transition period in the history of biology. Certainly he may be ranked as an embryologist and general zoologist or morphologist next to the best, and he was only inferior to such men as Müller, Owen, Huxley, Agassiz, Milne-Edwards. His best works in zoology were those on the embryology of the Salmonidæ and of the Gastropods, and the morphology of the Siphonophores. His attempts at classification were, however, not always successful, as seen in his separation of the Cephalopods as an independent type from the other molluscs.

He was a leader in founding the science of anthropology, but his *tour de force*, or microcephaly, was generally felt to be a mistake. As a promoter of marine zoological stations he was most useful, and he was no closet and museum naturalist, but was among the first to work by the seaside on living animals. He will be remembered as a leader in establishing the doctrine of evolution, though in advocating it he did not show the reserve as regards the supposed theological and philosophical bearings, nor cultivate the broad statesmanlike methods of Darwin, Lyell and others. As a controversialist his blows were less weighty and telling than those of Huxley, with less of his refinement, clearness and elegance of style, and knowledge and wide reading in philosophical literature. His life, however, was devoted to the good of his race. Though his religious nature was never cultivated, his moral nature was without a stain. His turbulent Celtic blood asserted itself at times, and his large patriotic heart led him to sympathize with the down-trodden and oppressed, and unlike most students he could doff his gown and rush into political struggles and wage effective warfare with voice and pen. Vogt's materialism, as well as Spencer's agnosticism, may answer a temporary purpose for the scientist as such, but not for the philosopher. We have to go outside the material and phenomenal world for an explanation of the universe. Vogt's position as a philosopher of the materialistic school is amply discussed by Lange in his History of Materialism, where he compares him with Moleschott. "Both men," he says, "though not without the stimulus of original research, shine chiefly in their talent for exposition. If Vogt is clearer and sharper in detail, yet Moleschott had given more thought to the rounding of the whole. Vogt more frequently contradicts himself; Moleschott is richer in propositions to which it is impossible to attach any definite meaning" (11, p. 264). But, as Lange well remarks in another place, "the whole cause of materialism is forever lost by the admission of the inexplicableness of all natural occurrences." Vogt's philosophical narrowness and opinionativeness is shown in his never changing his views in the later years of his life, when the occasion, if it ever occurred, for ultra materialistic views had passed away, to be replaced by agnosticism and by the monistic philosophy of Haeckel and others. It is sufficiently obvious that Vogt was unideal and unspiritual, practical and matter of fact, and quite unsuspicious of his own lack of breadth and grasp. His own studies must have constantly led him into the region of insoluble problems, but his modesty and humility was not of the order of Newton's, and he seemed utterly unconscious that he could not with a few words or strokes of the pen settle questions which have, and perhaps always will, baffle the keenest intellects and the most thoughtful minds.

Vogt, with whatever limitations he had, was a genuine man and true to his friends, with no personal enemies. The two portraits well delineate the man; not particularly winning or refined in features, but strong and true, reliable and earnest. The full-length portrait admirably depicts the man as we saw him one Sunday afternoon in 1889 in his laboratory at Villefranche. His students were out for a holiday and the old man was at work alone making a sketch of a jelly fish or some such creature, to be reproduced in his Traité d'anatomie comparée, on which he was then busily engaged. Affable and courteous, he took pleasure in showing us the simple apartments of the station, then under the direction of Prof. Korotneff.

The book is certainly not dull reading; it is enlivened by many characteristic anecdotes; at times it is a grain too eulogistic and uncritical, and the author's extreme radical and materialistic and anti-religious views in a degree warp his judgment and affect the saneness of some of his reflections. It would have been well if the book could have been revised by some scientific friend of the deceased.

We would have liked to see more of Vogt's own letters; remarkably few are given, nor are the summaries of his chief works sufficiently full and complete, or the dates always given, or the quotations accompanied by references to the title and page.

Had the book been written by an American, it is safe to say in these days of bibliographies, that a suitable one would have been added to this life, since Vogt lived in a transition period,

his earlier papers being included neither in Agassiz and Strickland's Bibliographia zoologiæ, which ends with 1854; nor in Taschenberg's, which begins with 1861; nor in the catalogue of the Royal Society. A. S. PACKARD.

Number and its Algebra; Syllabus of Lectures on the Theory of Number and its Algebra. By ARTHUR LEFEVRE. Boston, Heath. 1896. pp. 230.

In June, 1891 was published the first piece of a treatise entitled 'Number, Discrete and Continuous,' in which were set forth some doctrines which seemed to the writer, the present reviewer, as new as they were fundamental.

It was there maintained that counting is essentially prior to measuring, but also that the primary number concept is essentially prior to counting and necessary to explain the meaning, cause and aim of counting.

It was there maintained that integral number had not a metric origin, nor was metric in its original purpose; that integral number did not involve the idea of ratio, that in fact it was enormously simpler than that very delicate concept, *ratio*.

Number is primarily a quality of an artificial individual.

The stress laid upon it, the importance attached to this quality, comes first from the advantage of being able to identify one of these artificial individuals. By artificial is meant 'of human make.'

The characteristic of these artificial individuals is that each, though made an individual, is conceived as consisting of other individuals.

This explanation was set forth again concisely in an article entitled 'The Essence of Number,' in SCIENCE, Vol. III., pp. 470, 471.

The primitive function of number is to serve the purposes of identification. But again, counting, which consists in associating with each primitive individual in an artificial individual a distinct primitive individual in a familiar artificial individual, is thus itself essentially the identification, by a one-to-one correspondence, of an unfamiliar with a familiar thing. Thus primitive counting decides which of the familiar groups of fingers is to have its numeric quality attached to the unfamiliar group counted.

This primitive use of number in defining by identification is illustrated by an ordinary pack of playing cards, where the identification of King, Queen and Knave is not more clearly qualitative and opposed to every mode of measurement than is the identification of ace, deuce and tray; and, indeed, that the King outvalues the Knave has more to do with measurement than the fact that the ace outvalues the tray.

Counting implies, first, a known series of groups, mental wholes each made up of distinct wholes; secondly, an unfamiliar mental whole; thirdly, the identification of the unfamiliar group by its one-to-one correspondence with a familiar group of the known series.

Absolutely no idea of a unit, of measurement, of amount, of value, or even of equality, is necessarily involved or, indeed, ordinarily used. One counts when one wishes to find out whether the same group of horses has been driven back at night that were taken out in the morning; where counting is a process of identification which it would seem intentionally humorous or comical to try to connect fundamentally with any idea of a unit of reference or of some *value* to be ascertained, or of the setting off of a horse as a sample unit of value and then equating the total value to the number of such units. Such an *argumentum in circulo* may perhaps be funny, but it is neither fact nor mathematics. Mathematics afterwards defines numerical equality by means of one-to-one correspondence, which is absolutely distinct and away apart from the idea of ratio. We may say with perfect certainty that there is no implicit presence of the ratio idea in primitive number.

From the contemplation of the primitive individual in relation to the artificial individual spring the related ideas 'one' and 'many.' An individual thought of in contrast to 'a many' as not-many gives the idea of 'a one.' A many composed of 'a one' and another 'one' is characterized as 'two.' A many composed of 'a one' and the special many 'a two' is characterized as 'three.'

And so on; at first absolutely without counting, in fact before the invention of that patent process of identification now called counting.

For a considerable period of its early life every child uses a number system consisting of only three terms, *one*, *two*, *many*, and no counting. As datum may be taken a psychical continuum, and distinctness may be found the outcome of a process of differentiation; but what may be spoken of as the physically originated primitive individuals, however complete in their distinctness, have no numeric suggestion or quality.

The intuitive but creative apperception and synthesis of a manifold must precede its conscious analysis, which alone gives number.

It is only to conceptual unities that the numeric quality pertains. Such conceptual unities are of human make, and in a sense are not in nature, while, on the other hand, though the world we consciously perceive is out and out a mental phenomenon, yet the primitive individuals, distinct things, while forming part of the artificial unities, exist in another way, in that they are subsisting somehow in nature as well as in conscious perception.

With the preceding hints as to the reviewer's position in reference to fundamental matters in regard to which some strange blunders have been made of late by eminent philosophers and teachers, not mathematicians, it will be easy to understand why Lefevre's 'Number and its Algebra,' seems to us of exceptional importance just now to American teachers in general and teachers of pedagogy in particular. It is exceedingly timely, philosophic, bold, yet withal sound.

That the book was written down under exceptional difficulties makes only more noteworthy its general and sustained excellence.

That American teacher who does not read it is certainly doing an injustice to himself. In genuine compliment to the book, some points may be mentioned which the reviewer would have wished otherwise.

The fundamental idea of measurement comes perilously near to being misconceived. Section 12 says: "To the man whose concept of number is only what has been defined as primary number, measurement is hardly to be distinguished from counting. For measurement of discrete magnitude is counting; and to the intelligence supposed there is no real measurement of continuous magnitude." Now, on the contrary, the number or numeric picture of a group is a selective photograph of the group, which takes or represents only one quality of the group, but takes that all at once.

This picture process only applies primarily to those particular artificial wholes which may be called discrete aggregates. But the overwhelming importance of the number-picture, primarily as a means of identification, led, after centuries of its use, to a human invention as clearly a device of man for himself as is the telephone.

This was a device for making a primitive individual thinkable as a recognizable and recoverable artificial individual of the kind having numeric quality.

This recondite device is measurement. Measurement is an artifice for making a primitive individual conceivable as an artificial individual of the group kind, and so having a number picture. The height of a horse, by use of the unit 'a hand,' is thinkable as a discrete aggregate, and so has a number-picture identifiable by comparison with the standard set of pictures, that is by counting, as say 16.

And directly contrary to the position of Prof. Lefevre, the measurement of continuous magnitude surely came at just the very stage of intelligence to which he denies it, for the fraction had this very origin; it originated from the invention, the device, measurement.

Number long preceded any measurement, but measurement long preceded any idea of number as continuous.

In fact, measurement suggested not only fractions, but later the finer, more geometric idea, ratio, as is clearly presented in §80.

In Euclid's wonderful Fifth Book a ratio is never a number.

Newton, with the purpose of taking in the so-called surds or irrationals of arithmetic and algebra, assumed a ratio to be a number. Any continuity in his number system comes then from the continuity in the magnitude whose ratio to a chosen unit for that magnitude is taken. He never gave any arithmetical or algebraic proof of the continuity of any number system.

Certain passages in Mr. Lefevre's book might easily suggest that somewhere in it, never cited, he has himself treated this basal problem of

modern mathematics, which Newton never touched, and which has only been made imperatively necessary by the discovery of non-Euclidean geometry. As one of many, take this sentence from his introduction, p. 14, "I am well aware that there are other avenues of approach to the thesis here maintained,—that 'various new mathematical conceptions have been employed by Weierstrass, G. Cantor and Dedekind in establishing three independent and equally cogent theories which should prove the continuity of number without borrowing it from space,' to say nothing of such theories (*e. g.*, Fine's *Number-System*) as are 'content to get continuity from the line.' The criticism of Fine, here quoted from Halsted's *Number, Discrete and Continuous*, was acknowledged as valid in a public meeting of the American Mathematical Society, but it applies with equal cogency to Lefevre, who here mentions it. In § 41, page 43, Fine outlines an argument for the continuity of the number system from the assumption of measurement or obtaining ratio by geometric congruence and the assumption that 'the geometric magnitudes are continnous.'

Lefevre does not devote even a single section, nor indeed even a single word, that I can find, to any attempt at proving even any piece of a number system continuous.

Neither Fine nor Lefevre give any hint that they have yet heard of the fact that the non-Euclidean geometry has made it a life-or-death matter for mathematics to have a continuous number system not based in any way upon geometric congruence, and so absolutely independent of measurement and ratio.

But this new problem the book under consideration does not pretend to have attacked. More than justified is its modest claim put forth on page 112: "It seems to me something to put neomonic numbers on the same footing as negative numbers, or even numerical fractions."

George Bruce Halsted.
Austin, Texas.

Pioneers of Science in America. With portraits. Edited and revised by William Jay Youmans, M. D. New York, D. Appleton & Co. 1896.

This octavo volume consists of fifty biographical sketches of early American scientists with descriptions of their scientific work. Originally they appeared in *Appleton's Popular Science Monthly*, but have since been revised, and additions made to them for their present form. The first of these sketches is on Benjamin Franklin, our first great American scientist, and is from the pen of Mr. W. H. Larrabee, of the *Popular Science Monthly* editorial staff. The scientific attainments of Franklin have never yet been fully appreciated and Dr. Youmans, who edited the collection, well says in his preface that the present article 'is the first systematic account of what Franklin did in science that has appeared.' The reference on page 10 to Dr. Goode's paper, read at the time of the commemoration of the centennial of Franklin's death by the American Philosophical Society, is suggestive of the fact that for many years Dr. Goode claimed that the beginnings of science in this country could invariably be traced back to Franklin.

A sketch of the two Bartrams, father and son, follow, and soon after these one of David Rittenhouse, who succeeded Franklin in the presidency of the American Philosophical Society. These, together with the sketches of Benjamin S. Barton, Gerald Troost, Robert Hare and others, make conspicuous the fact that early in the century Philadelphia 'presented more advantages in science than any other place in the country.' And so, according to the sketch of the elder Silliman, he went there for instruction in chemistry to Hare, and took lectures in botany of Barton. Silliman's able pupils, including Edward Hitchcock, Dennison Olmsted and Charles U. Shepard, find a place in the book. New York comes in for its full share with the account of Samuel Latham Mitchell, who was the Franklin of the metropolis, so universal was his knowledge. Dr. Francis said of him: "In the morning he might be found composing songs for the nursery; at noon dietetically experimenting and writing on fishes, or unfolding to admiration a new theory on terrane formations; and at evening addressing his fair readers on the healthful influence of the alkalies and the depurative virtues of whitewashing." Nor is David Hosack omitted. It was he who in 1801 founded the Elgin Botanical Garden in New York City, which property

afterwards was given to Columbia University. Torrey, who later was called to the Chair of Botany in Columbia University that had been held by Hosack, with his many and valued scientific attainments, is described at length. The early history of geology in New York State is recalled by the sketches of William W. Mather, Timothy A. Conrad, Ebenezer Emmons and Lardner Vanuxem, who with James Hall constituted the chiefs of the first geological survey of the Empire State. The pioneer in science at Harvard was John Winthrop, who was 'better entitled to the character of a universal scholar than any individual of his time in this country.' Other Harvard scientists included in the volume are William C. Bond, who founded its astronomical observatory, and Louis Agassiz, to whom we owe the Museum of Comparative Zoology in Cambridge. Two of Agassiz's associates, Guyot, the geographer, and Lesquereux, the paleobotanist, are appropriately treated. In a popular work, such as the present volume, a sketch of S. F. B. Morse may perhaps be necessary, but when we consider that "the essential features of the telegraph of to-day consist solely of the work of Joseph Henry and Alfred Vail," and to quote from the sketch of Henry (p. 358), "The principles I had developed were applied by Gale to render Morse's machine effective at a distance," it would seem that the space given to Morse could with propriety have been assigned to some other worthy. Of the Washington scientists Bache, Maury and Espy, as well as Henry, have been included. The Espy sketch is somewhat faulty, having been prepared from Mrs Morehead's reminiscences. Prof. Espy's work was chiefly done while in the service of the navy department and at the Smithsonian Institution, of which he was never a regent. The absence of sketches of J. C. Redfield, our greatest meteorologist subsequent to Franklin, and of Henry D. Rogers, the able geologist, is probably explained by the fact mentioned by Doctor Youmans in the preface namely: "Should the book be found of sufficient interest to warrant the venture, a second volume on a similar plan may follow."

Taking the book as a whole, it is almost entirely free from errors and may be regarded as the best contribution to the history of American Science that has yet appeared.

MARCUS BENJAMIN.

Auto-Cars, Cars, Tram-Cars and Small Cars. By D. FARMAN, M. E., M. I. E. E.; Translated from the French by L. SERRAILLIER. With a preface by BARON DE ZUYLEN DE NYEVELT, President of the Automobile Club of France. With 112 illustrations. London, Whittaker & Co.; N. Y., The Macmillan Co. 12mo., pp. 249. $1.50.

This little book presents an excellent discussion of a branch of engineering which has recently assumed great importance in the eye of the public and, perhaps to less extent, in the opinion of the engineering profession. The revival of the once extensively introduced and very successful automobile system of transportation on the highway which, sixty years ago and more, had come to be a well established branch of locomotion, has attracted the attention of the whole world. Steam carriages, petroleum engines, electric apparatus, are coming into view in all civilized countries, and in great number and variety. This volume gives an interesting, an accurate and a very complete account of the 'horseless vehicles' of all classes, and is brought up to date—an unusual and most satisfactory circumstance in technical bookmaking. The introduction includes a well-planned and well-made elementary study of the thermodynamics of the case, and includes the discussion of the cycles of Carnot and of the steam-engine. An historical account succeeds in which the work of the earlier engineers in this field is described; though, singularly enough, nothing is said of the wonderful work, for the time, of Goldsworthy Gurney, of Hancock, of Sir Charles Dance, and of a dozen other inventors who successfully inaugurated this system about 1830. At that time twenty or thirty steam carriages were in regular or experimental operation in and about London, and some of them traversed thousands of miles and were employed on regular routes for months at a time, carrying thousands of passengers. It was then that the laws which have since, until recently, been fatally discriminating against that class of

motors, were instituted. The theory of the various types of motor next follows and a brief study is made of the several forms of motor now coming into use, with more or less success, in the impulsion of these 'horseless vehicles.'

The body of the work is devoted to a description of the construction of the new 'automobile' carriages which have within a few years become known on the road, and this includes an account of the forms of American as well as European apparatus which have been brought into competition in long-distance trials and races. Some valuable matter is also given in the form of reports, embodying data of interest and value to the constructing engineer.

The concluding portion of the book deals with details of construction. This is a good time to bring out such a work, and the author appears to have made a success of his part. The book is the work of an expert, and no doubt reliable as to fact as well as correct in its descriptive matter. It is well worth its price.

R. H. Thurston.

Cornell University.

SCIENTIFIC JOURNALS.

American Chemical Journal, December.

Investigations on the two Isomeric Chlorides of Orthosulphobenzoic acid: By Ira Remsen, S. R. McKee, J. R. Hunter and W. J. Karslake. These articles contain the results of investigations carried on during the last two years on the preparation and behavior of the chlorides of orthosulphobenzoic acid. They have been obtained in pure condition, the high-melting one by treating the mixture with ammonia, which destroys the low-melting one, and crystallizing the product from ligroi ; and the low-melting one by fractional crystallization of the mixture. When treated with water both give the same product, orthosulphobenzoic acid. Phenol and resorcinol were also found to yield the same products with the two chlorides. When treated with aniline the high-melting chloride yields only the fusible anilide, while the low-melting one yields both the fusible and and infusible anilides. When these anilides are treated with phosphorus oxychloride they both yield orthosulphobenzodianil, from which the infusible anilide can be regenerated by boiling with glacial acetic acid, and the anil of orthosulphobenzoic acid by treatment with concentrated hydrochloric acid. The evidence shows that the infusible anilide is derived from the unsymmetrical chloride by the replacement of the two chlorine atoms by the aniline residues. When the high-melting chloride is treated with ammonia the product is the ammonium salt of benzoic sulphinide, while the low-melting one forms ammonium orthocyanbenzenesulphonate. From all the data available it seems to be hardly possible to explain the formation of the latter compound, except from the unsymmetrical chloride. The first action probably leads to the formation of an imide which by an intramolecular change passes over to orthocyanbenzenesulphonic acid. The product formed by the action of benzene and aluminium chloride was the same from both chlorides.

On the Non-existence of two Orthophthalic Acids: By H. L. Wheeler. An article was published, in the May number of this Journal, by W. T. H. Howe, on the existence of two orthophthalic acids. The work has been repeated by H. L. Wheeler, who found it impossible to prepare the new acid described by Howe. He says the experimental work is absolutely incorrect, and that only the ordinary orthophthalic acid was obtained, although the experiments of Howe's were carefully repeated a number of times.

A Pure Carbide of Iron: By E. D. Campbell. The author has succeeded in obtaining a pure carbide of iron of the formula CFe_3 by carefully annealing steel bars and then suspending them in an acid solution and passing a current through the solution. The steel-gray powder formed on the surface was removed each day with an aluminium brush, and washed and analyzed. When treated with hot concentrated hydrochloric acid the substance was dissolved, forming the chloride of iron and hydrocarbons. The latter consisted both of paraffines and olefines; but their exact composition was not determined.

The Alkali Trihalides: By C. H. Herty and H. V. Black. The authors have tested the rubidium trihalides to determine whether they are isomorphous mixtures or true chemical compounds. Repeated crystallizations failed to produce any change in the composition of the